



A Small New Keynesian Model of the New Zealand Economy

RBNZ DSGE Workshop 2005

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Objectives

- ✓ A simple and transparent tool for monetary policy simulations
- ✓ NZ's characteristics
- ✓ Open economy focus
- ✓ Allow for parameter and model uncertainty
- ✓ Take advantage of recent modeling developments
- ✓ Complement existing policy tools
- ✓ To learn...



NZ Macro models, some examples

- ✓ FPS/NZTM: large GE models, similar theoretical foundations, include stock flow accounting, differ in degree of estimation
- ✓ Buckle et al (2002) SVAR: empirical, business cycle decomp, weak theoretical foundation
- ✓ SOE DSGE: Lubik and Schorfheide (2003), Justiniano and Preston (2004), Lubik and Teo (2005)

Empirical DSGE modeling

- ✓ Need for a small empirical and theoretical consistent model
- ✓ Focus on structural characteristics and its implied dynamics
- ✓ DSGE with nominal rigidities, so-called New Keynesian Models
 - ★ Rational expectations, dynamic optimizing GE framework
 - ★ “Deep” parameters, suitable for policy analysis
 - ★ Tools for learning DGP
 - ★ Coupled with Bayesian estimation, inference statements can be guided by data

Outline

- ✓ The model
- ✓ Estimation and data
- ✓ Results
- ✓ A simple question
- ✓ Conclusion

Model overview

- ✓ Taking Monacelli (2005) as starting point, allow for external habits and inflation indexation
- ✓ Representative household max. $U(\tilde{C}_t, 1 - N_t)$
- ✓ Firm max $E_t \sum_{t=0}^{\infty} \Pi_t$ and set prices in a Calvo-staggered fashion
- ✓ Linear production technology in labour
- ✓ Complete international financial markets
- ✓ Nominal rigidities in import price pass-through

Some details.....Household

$$\text{Max.} \quad E_t \sum_{t=0}^{\infty} \beta^t \left\{ \frac{(C_t - H_t)^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\varphi}}{1+\varphi} \right\}$$

$$\text{s.t} \quad \{P_{H,t}C_{H,t} + P_{F,t}C_{F,t}\} + E_t\{Q_t D_{t+1}\} \leq D_t + W_t N_t$$

$$\text{and} \quad C_t = \left((1-\alpha)^{\frac{1}{\eta}} C_{H,t}^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}$$

$$\text{FOCs:} \quad (C_t - H_t)^{-\sigma} \frac{W_t}{P_t} = N_t^{\varphi}$$

$$\beta R_t E_t \left\{ \frac{P_t}{P_{t+1}} \left(\frac{C_{t+1} - H_{t+1}}{C_t - H_t} \right)^{-\sigma} \right\} = 1$$

Domestic firm

Price indexing firm (θ_H), $p_{H,t}^I = p_{H,t-1} + \theta_H \pi_{H,t-1}$

Optimizing firm ($1 - \theta_H$),

$$\max_{\bar{P}_{H,t}} \sum_{k=0}^{\infty} \theta_H^k E_t \left\{ Q_{t+k} \left[Y_{t+k} (\bar{P}_{H,t} - MC_{t+k}) \right] \right\}$$

s.t: demand (Y_t) and production ($Y_t = A_t N_t$)

$$\bar{p}_{H,t} = p_{H,t-1} + \sum_{k=0}^{\infty} (\beta \theta_H)^k E_t \left\{ \pi_{H,t+k} + (1 - \beta \theta_H) m c_{t+k} \right\}$$

$$\Rightarrow \pi_{H,t} = \beta(1 - \theta_H) E_t \pi_{H,t+1} + \theta_H \pi_{H,t-1} + \lambda_H m c_t$$

Importer

Price indexing firm (θ_F), $p_{F,t}^I = p_{F,t-1} + \theta_F \pi_{F,t-1}$

Optimizing firm ($1 - \theta_F$),

$$\max_{\bar{P}_{F,t}} \sum_{k=0}^{\infty} \theta_F^k E_t \left\{ Q_{t+k} \left[C_{F,t+k} \left(\bar{P}_{F,t} - \frac{P_{t+k}^*}{Z_{t+k}} \right) \right] \right\}$$

s.t: demand ($C_{F,t}$)

$$\bar{p}_{F,t} = p_{F,t-1} + \sum_{k=0}^{\infty} (\beta \theta_F)^k E_t \{ \pi_{F,t+k} + (1 - \beta \theta_F) \psi_{t+k} \}$$

where $\psi_t = p_{t,NZ\$}^* - p_{F,t}$

$$\Rightarrow \pi_{F,t} = \beta(1 - \theta_F) E_t \pi_{F,t+1} + \theta_F \pi_{F,t-1} + \lambda_F \psi_t$$

Some more details.....

✓ Exogenous foreign sector

✓ Goods market clearing condition:

$$Y_t = (1 - \alpha) \left(\frac{P_{H,t}}{P_t} \right)^{-\eta} C_t + \alpha \left(\frac{Z_t P_{H,t}}{P_t^*} \right)^{-\eta} C_t^*$$

✓ Perfect IFM, UIP condition:

$$E_t \Delta q_{t+1} = -(r_t - \pi_{t+1}) - (r_t^* - \pi_{t+1}^*)$$

✓ Simple monetary policy reaction function:

$$r_t = \rho_r r_{t-1} + (1 - \rho_r) [\phi_1 \pi_t + \phi_2 \Delta y_t]$$

Bayesian approach

For a particular model i , we have

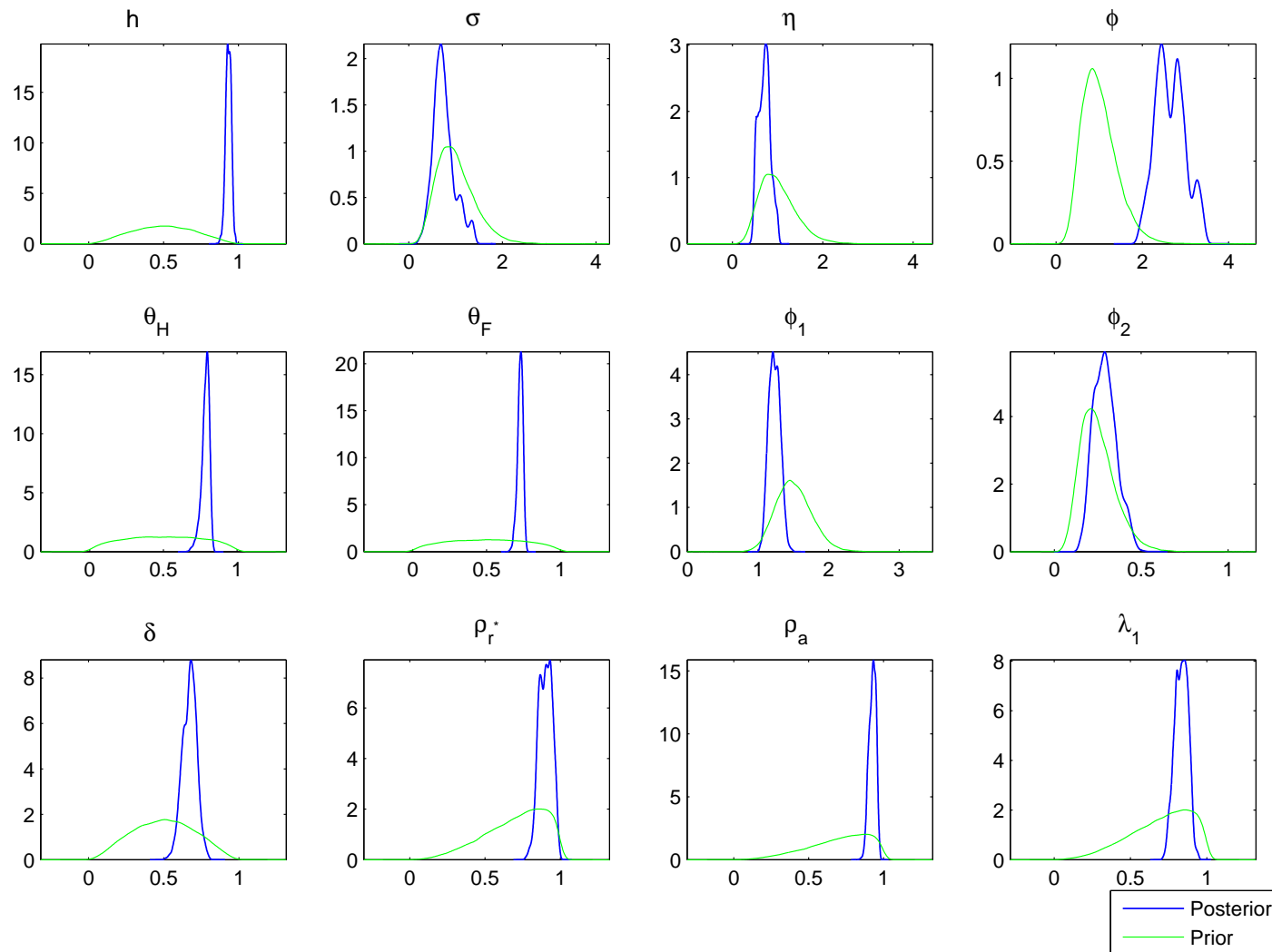
$$p(\Theta|Y^T) \propto L(Y^T|\Theta)p(\Theta)$$

- ✓ $L(Y^T|\Theta)$ information in the sample
- ✓ $p(\Theta)$ reflect prior beliefs
- ✓ Posterior distribution, $p(\Theta|Y^T)$, a way of weighting the information in the sample according to the researcher's prior
- ✓ Formal mechanism for incorporating judgement in the modeling process

Data and prior

- ✓ Quarterly 1991Q1 to 2004Q4, y_t , r_t , π_t , π_t^M , q_t , y_t^* and \bar{r}_t^*
- ✓ y_t^* and \bar{r}_t^* are 80% US and 20% Australia
- ✓ non-stochastic linear trend taken out of y_t and y_t^*
- ✓ all other variables rescaled to have a mean of zero
- ✓ Priors
 - ★ short sample in NZ
 - ★ other studies, FPS and own judgement
 - ★ relatively “flat”, updated by the data
- ✓ Random walk MH in Lubik and Schorfheide (2005) to generate 200k draws of the posterior distribution, 100k burn in

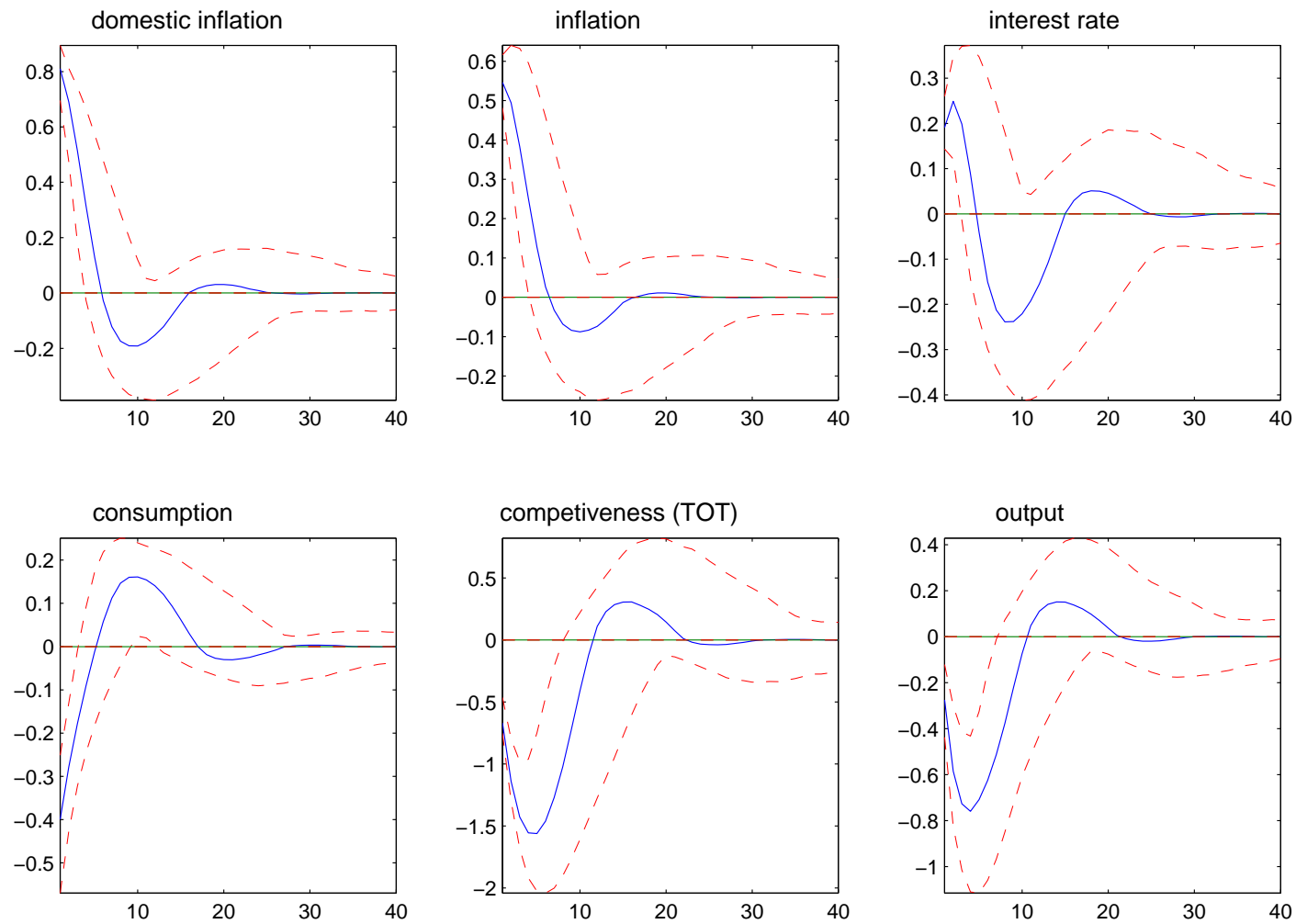
Prior and posterior plots



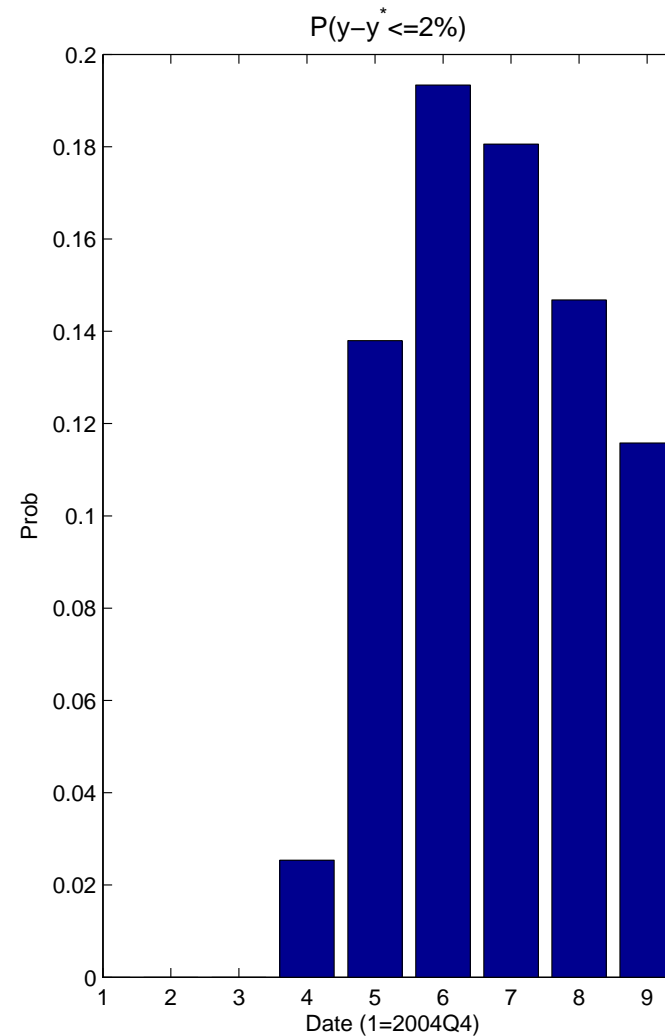
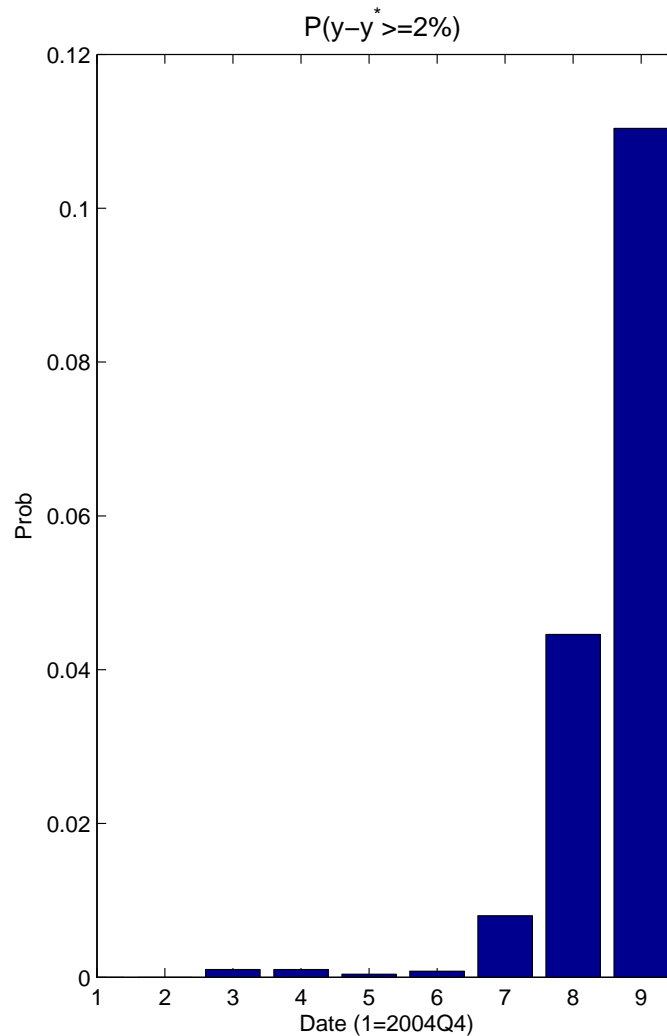
Estimated structural characteristics

- ✓ Posterior shaper than prior
- ✓ High degree of habit persistence
- ✓ Relatively high intertemporal substitution, effect of monetary policy on consumption
- ✓ Low degree of substitution between home and foreign goods, commodity producer
- ✓ Low labor supply elasticity
- ✓ Average price contracts: 5 quarters for domestic firms and 4 quarters for import retailers
- ✓ $r_t = 0.675r_{t-1} + (1 - 0.675)[1.230\pi_t + 0.288\Delta y_t]$

Domestic inflation shock



What's the probability of output being 2% above and below average?



Conclusion and future development

- ✓ Preliminary results are encouraging
 - ★ sharp posterior relative prior, historical data are informative in identifying Θ
 - ★ estimated parameters largely reflect NZ characteristics
 - ★ useful for quantifying parameter and model uncertainty
- ✓ We had restricted ourself to a relatively simple model, one may consider including:
 - ★ add K_t and G_t to complete the macro picture
 - ★ allow for a more complete description of the labour market
 - ★ two-good model